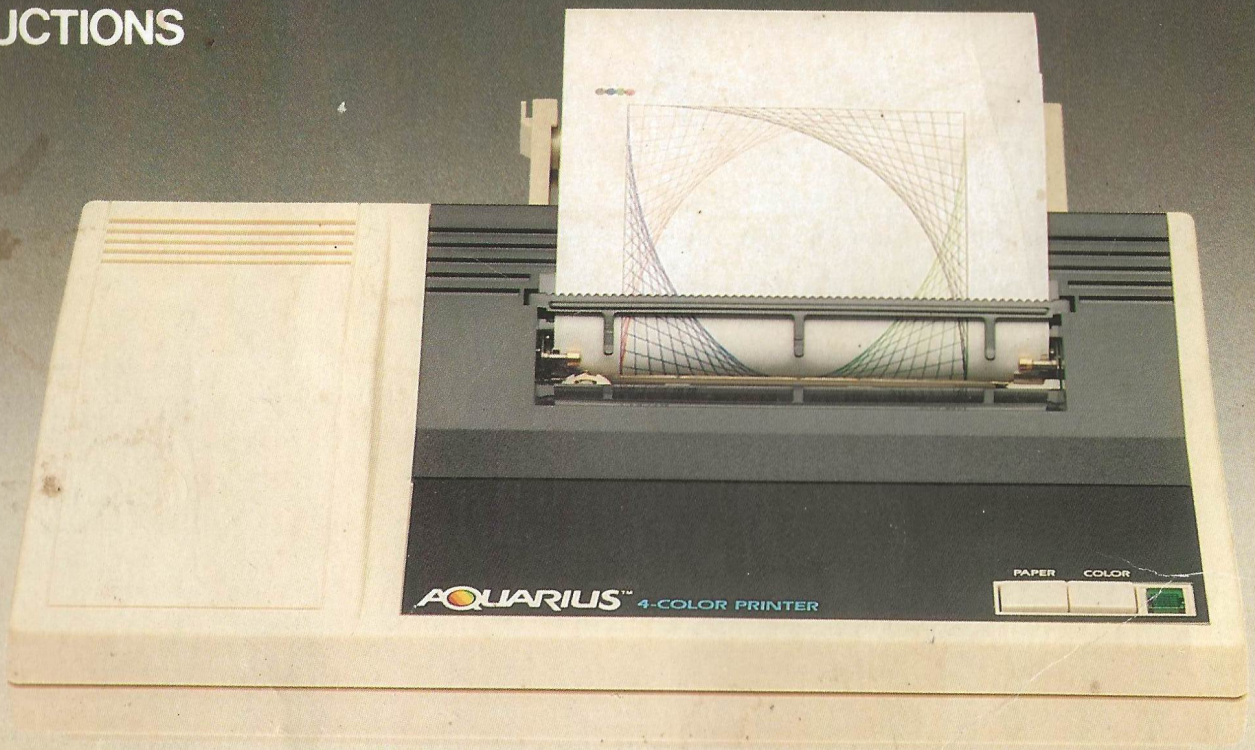
AQUARIUS™
HOME COMPUTER SYSTEM

4-COLOR PRINTER

INSTRUCTIONS



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INTRODUCTION

AQUARIUS 4-COLOR PRINTER

The Aquarius 4-color Printer is going to let you do all sorts of things that you just couldn't do with any other type of printer.

The Aquarius 4-color Printer is three things all in one:

- ☐ It's a **color text and graphics printer.**
- ☐ It's a **screen copier**, copying exactly what's on the screen of your Aquarius computer.
- ☐ It's a **color plotter**, drawing whatever you tell it — graphs, charts, engineering diagrams, or just doodles!

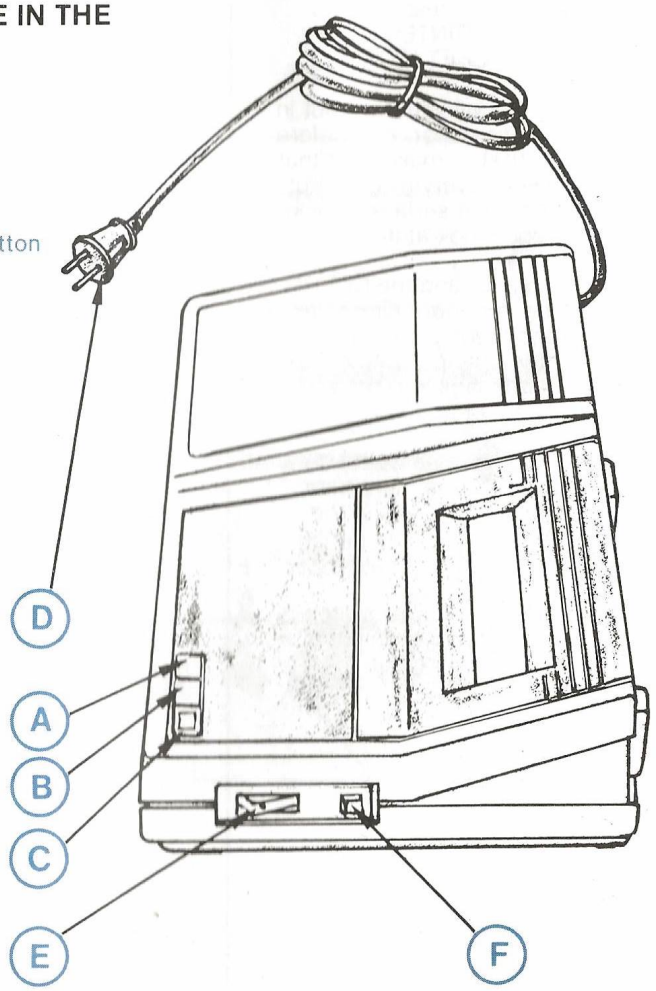
CHAPTER 1

FIRST STEPS

(What's where in the printer, putting in the paper, taking out the old roll)

WHAT'S WHERE IN THE PRINTER

A: 'Paper' button
B: 'Color' button
C: Power lamp
D: Power cable
E: Power switch
F: Cover release button



First, an important message: DO NOT PLUG THE PRINTER INTO THE POWER SOCKET YET.

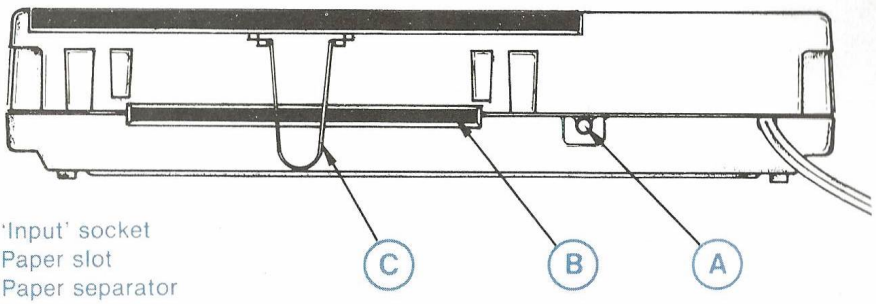
Don't plug it in until you have put in the pens and the paper. And before you even do **that** ... make sure that you know where everything is! Put the printer on a flat surface so you can take a good look at it.

The PAPER button and the COLOR button will be important later (the PAPER button feeds paper, and the COLOR button changes pen color). The power lamp is just to tell you that the printer is turned on.

The power switch does what you expect it to — it turns the printer on or off. When you press in the end with the white dot, the printer is ON.

Make sure that the power switch is **off** — the part with the white dot on it should be sticking out.

The 'input' socket is where you will be connecting the printer to the computer. The paper slot is ... where you put the paper in (pretty obvious, really).

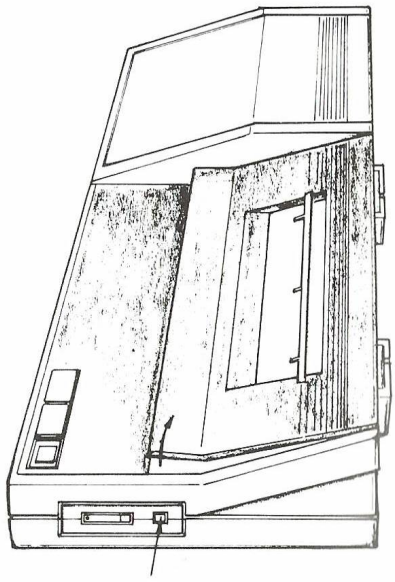


A: 'Input' socket
B: Paper slot
C: Paper separator

Above the slot is a piece of springy wire in a U shape. This is called the 'paper separator', and it will keep the paper going in the right direction. If the piece of wire comes out accidentally, you can put it back in by gently squeezing the ends together and putting them back into the holes.

Press the cover release button. The printer cover will spring open slightly. Lift the cover up and take a look inside.

By the way, NEVER OPEN THE COVER JUST BY PULLING ON IT — ALWAYS USE THE COVER RELEASE.



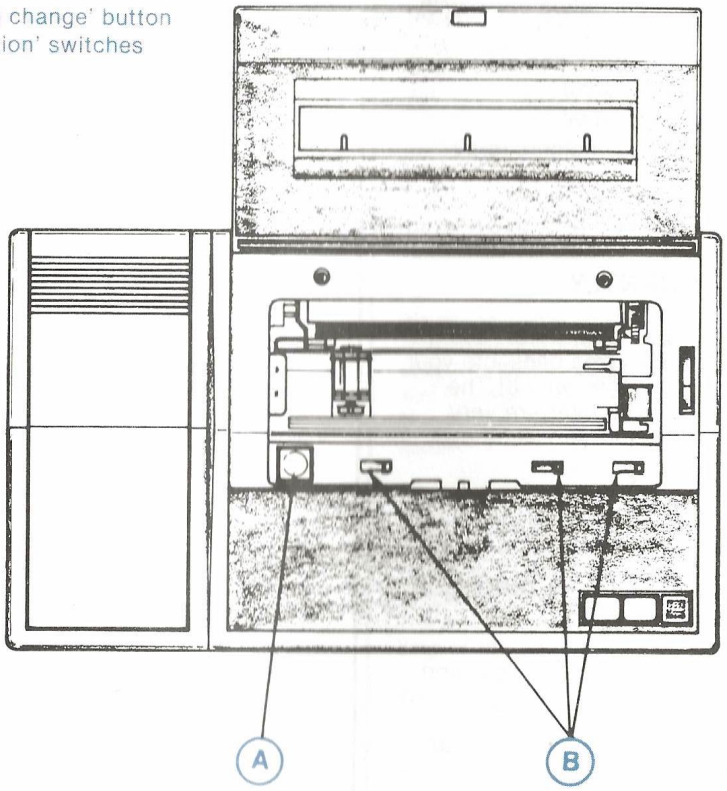
Inside the printer, there are a button and three switches — don't worry about them too much now, but they are called the 'pen change' button and the three 'option' switches.

Make sure that all three of the option switches are pushed all the way to the right (just like in the diagram).

Close the cover of the printer and push it down until it clicks.

NOTE TO OWNERS OF NON-AQUARIUS COMPUTERS: If you are going to use the printer with any computer other than the Aquarius, please check page 55 for instructions on how to set the option switches.

A: 'Pen change' button
B: 'Option' switches



BITS AND PIECES

Now take a look at what else came with the printer You should have:

☐ A printer connecting cable with a plug on each end of it

☐ Two sets of pens (the long multi-colored plastic tubes)

☐ Two rolls of paper

☐ Two paper roll holders (gray plastic parts)

☐ This manual!

GENTLY GENTLY

BE CAREFUL: You are now going to put the paper and pens into your printer — be gentle with it! The parts inside the printer are very delicate, so treat them like they were family.

A MAJOR ROLL — putting in the paper

Take one of the rolls of paper and get the end loose.

The next thing to do is to tear off the first twelve inches or so of paper — it may have glue on it, and you don't want **that** to go into the printer!

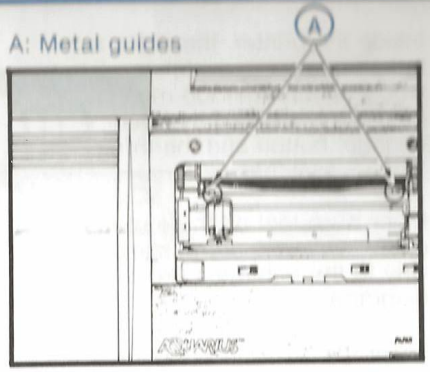
Now cut the end of the paper square. Take a pair of scissors and cut across the paper so that the corners are neat.

Unroll a couple of feet of paper and put the end of the roll into the paper slot at the back of the printer. MAKE SURE THAT THE ROLL IS GOING TO BE THE RIGHT WAY UP. The paper will come from the BOTTOM of the roll.

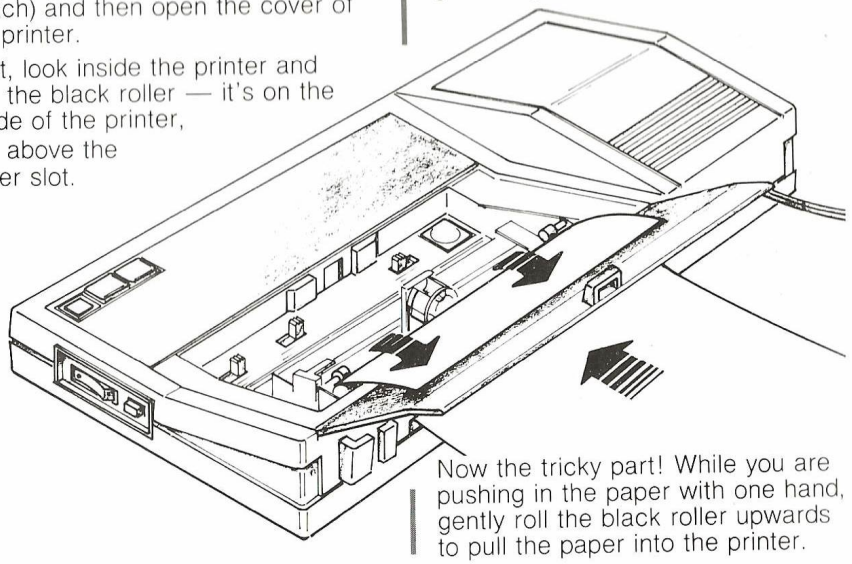
When you have put the end of the paper into the slot, press the cover release button (on the right hand side of the printer, near the power switch) and then open the cover of the printer.

First, look inside the printer and find the black roller — it's on the inside of the printer, just above the paper slot.

A: Metal guides



Now push the paper into the paper slot until it won't go any further — you may have to 'wiggle' it a bit to get it to go all the way in.



Now the tricky part! While you are pushing in the paper with one hand, gently roll the black roller upwards to pull the paper into the printer.

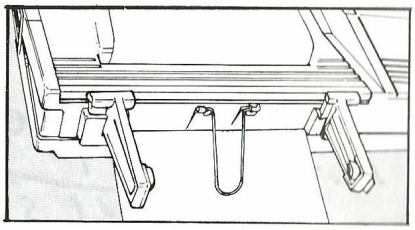
DO NOT TOUCH ANYTHING INSIDE THE PRINTER EXCEPT THE BLACK ROLLER.

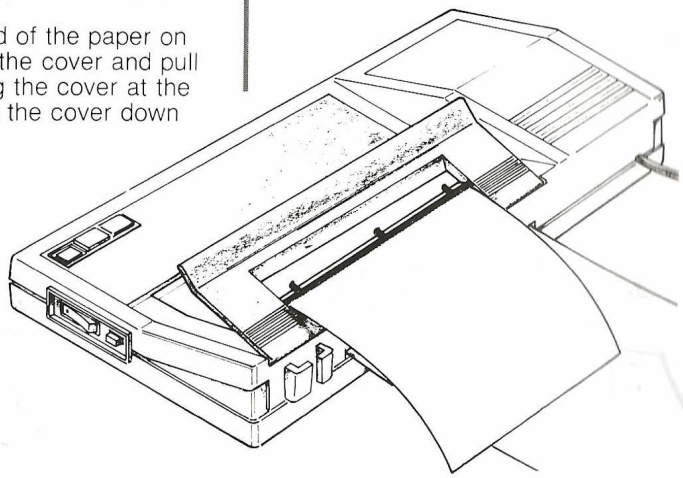
Make sure that the paper goes behind **both** of the metal guides at either end of the roll. Take hold of the end of the paper inside the printer and pull it up about 6 inches.

Take a look at the printer cover. You will see three little tabs sticking up. Pull the cover towards you a little and look just under the three tabs. There is a slot there — that's where the paper has to go.

Carefully feed the end of the paper through the slot.
Now grab the end of the paper on the other side of the cover and pull it through, closing the cover at the same time. Press the cover down until it clicks.

You should still be able to see the three little tabs when the cover is closed. If you can't, then you put the paper through the wrong hole in the cover. Pull it back and do it again.





Now take the 'paper roll holders' and fit them to the back of the printer, like in the diagram here. Just push them down until they fit tightly. If they don't fit the first time, try swapping them.

You can take them out later (if you want to re-pack the printer for traveling) just by pulling them upwards.

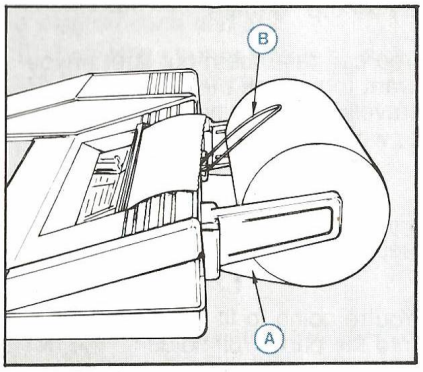
First, make sure that the paper separator is pointing upwards.

You're going to fit the paper roll into the paper roll holders. The best way to do this is to slip one of the roll holders up out of its fitting, put the roll in, and then put the holder back.

Pick up the roll and wind it up so that there's not much 'slack', then take out one of the paper roll holders. Put the roll onto the other holder, so that the plastic knob of the holder goes into the hole in the end of the roll.

Now check that the paper separator is still pointing upwards. Put the other roll holder back into its fitting, making sure that the plastic knob goes into the hole in the end of the roll.

A: Paper must be coming out of the **bottom** of the roll
B: Paper separator must go **above** the roll



Now check that:

☐ the paper separator is **above** the roll, and

☐ the paper comes out of the **bottom** of the roll ... see the diagram.

☐ the roll can rotate freely on the roll holders

And that's it for the paper! (Wasn't all **that** hard, now, **was** it?).

GETTING THE OLD ROLL OUT

By the way, there is a tag sticking out of the back of the left-hand roll holder, and that's for getting the roll out again when it is finished. You just pull the tag gently to the left, and the empty roll will pop out.

325
.06
19.50

325
19.50
3 44.50
34.
5 | 310.50
62.

375
06
22.50

275
22
7.50

148.
2 | 297

CHAPTER 2

UP AND RUNNING

(Putting in the new pens, taking out the old ones, connecting to the computer)

GET TO THE POINT — putting in the pens

Don't fit the pens until you have the paper in.

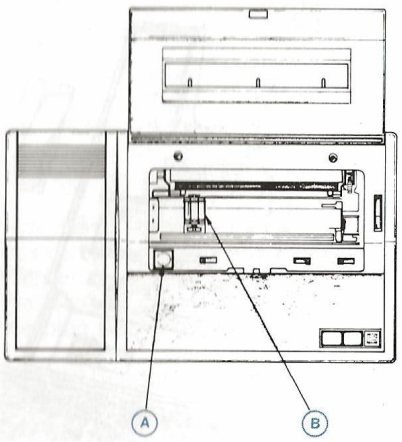
To put the pens into the printer, you have to plug the power cord into a wall power outlet.

DON'T PANIC ... When you turn the printer on, it will click, buzz, and the white plastic pen holder will move around — but DON'T PANIC. Just wait for it all to stop (it takes around fifteen seconds).

Plug the printer into the wall outlet, and then turn the power switch to ON (press in the end of the switch that has the white dot on it). The printer will make all sorts of funny noises for fifteen seconds. Notice that the green light has come on, too.

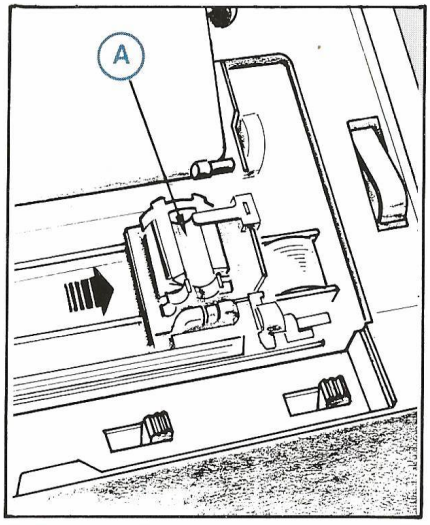
Now press the cover release button, and open the printer cover. Be careful not to let the paper slip out of the slot while you're doing it (pull some more through if you need to).

A: 'Pen change' button
B: 'Pen holder'



Take a look inside. The 'pen holder' is at the left of the printer, near the paper. NEVER MOVE THE PEN HOLDER WITH YOUR FINGERS. A GOOD HABIT TO GET INTO IS TO NEVER EVEN **TOUCH** THE PEN HOLDER.

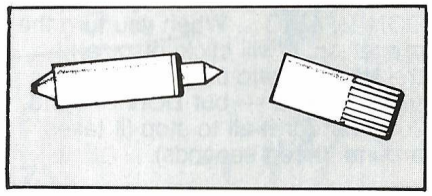
A: Pen holder



Push the 'pen change' button. The pen holder will move across until it is at the right-hand end of the paper (real neat, isn't it?).

Open the set of pens (pull the black plastic plug out of the end of the tube) and take the pens out.

There are four of them, and each has a colored plastic cap on it. Pick up the one with the black cap. No prizes for guessing what color pen it is!

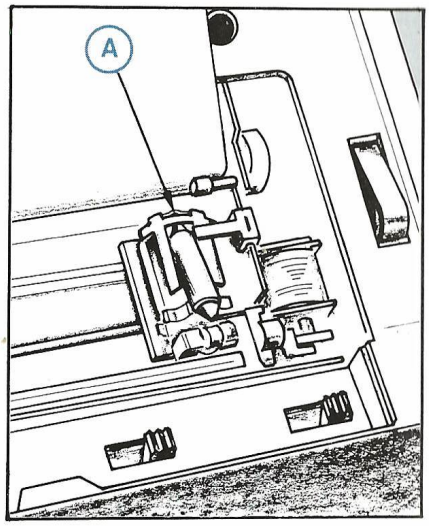


Take the cap off (just pull it) and take a close look at the pen itself. One end of it looks just like the tip of an ordinary ballpoint, and the other (let's call it the 'blunt' end) is just plain metal.

There is a black plastic ring around the 'ballpoint' end. This tells you the color of the pen, even after you have taken its plastic cap off.

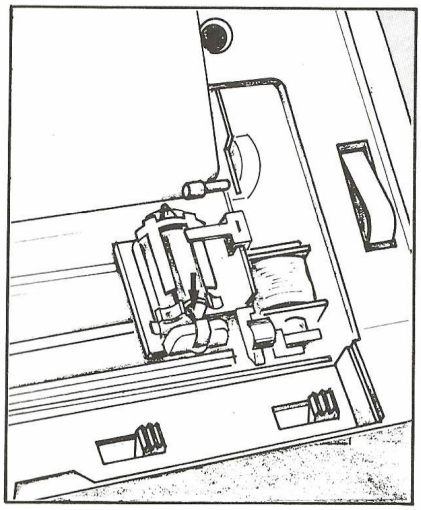
Pick up the pen, and use the 'ballpoint' end to write on a piece of paper — notice that, like a ballpoint, you might have to scribble a bit to get it to work.

A: Ballpoint end of pen goes at this end



With the ballpoint end **towards** the paper, put the pen into the slot in the top of the pen holder.

Now gently push it down until it clicks into place.



Now take the cap off the **blue** pen, and write with the pen on a piece of paper.

Press the button on the top of the printer marked COLOR. The pen holder will move to the left-hand end of the paper, it will rotate, and then it will move back to the right-hand end).

Put the **blue** pen into the pen holder.

Press the COLOR button again, and then take the **green** pen out, write with it, and put it into the holder.

Press the COLOR button one last time, and then take the **red** pen out, write with it, and put it into the holder.

Then close the cover of the printer, and push it down until it clicks.

If you get confused about the order in which to put in the pens, there's an easy way to find out. If you look closely at the pen holder, you will see that on the end nearest you there are a couple of little colored marks.

There are spots of ink to show you what pen color to put in that slot in the holder.

Or you can turn the printer off, then on again. When you do that, it will automatically go to the black pen position.
The order to put the pens in is:

- ☐ black
- ☐ blue
- ☐ green
- ☐ red

THE OLD ROUTINE — START-UP

Turn the printer off, wait for about a minute, and then turn it back on again.

The printer will go through its 'start-up' routine — that is, to draw four filled-in circles, one in black, one blue, one green and one red.

This is the printer's way of telling you that all is well, and that all four pens are working. Every time you turn the printer on, it will go through this little routine.

Now take the pen caps (those colored plastic parts that were on the pens) and put them back into the plastic tube they came in. Put the plug back into the tube.

You will need the pen caps if you turn the printer off for more than a day or two.

UNLIKE NORMAL BALLPOINT PENS, THE PRINTER PENS **WILL** DRY OUT, so always take the pens out when you are not going to be using the printer for a while.

READY TO ROLL — COLOR and PAPER buttons

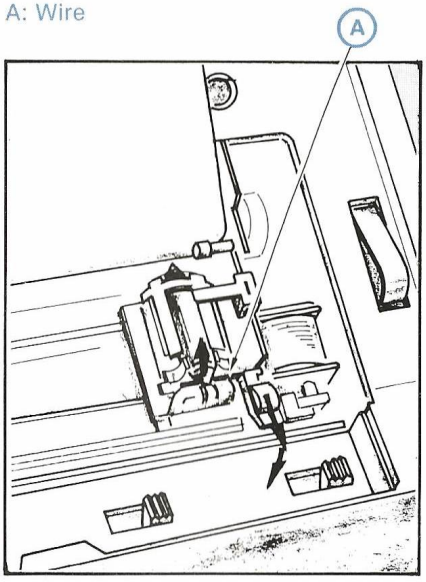
Now the printer is ready to roll!

Press the button on the top of the printer marked COLOR. The pen holder will move to the left and rotate. The COLOR button lets you change the color of pen that the printer is using. There are ways of doing it automatically, too, of course.

Press the PAPER button. Paper will be fed out of the top of the printer. The PAPER button is very useful for moving the paper, without touching it with your fingers.

DON'T DRY OUT! — taking out the pens

A: Wire



Taking the pens out of the printer is very easy. First, the printer must be turned on. You open the top cover of the printer, and press the 'pen change' button (see diagram on page 5). The pen holder will move to the right of the paper. Now look at the pen holder closely. You will see a little metal wire sticking out under the pen. Next to that wire is a white plastic knob, which sticks up.

The top of the knob is rough to the touch. Pull it towards you. The wire will lift up, and the pen will spring out of the holder.

Very carefully, lift the pen out of the holder.

If the pen accidentally drops into the printer, take the plug out of the wall socket, take the paper out of the printer (just pull it out from the roll end), take the roll off the roll holder, turn the printer upside down and shake it until the pen drops out!

Okay, so now you have the first pen out. Put it into its plastic cap so it won't dry out.

Now press the COLOR button. The pen holder will go across to the left, rotate, and then come back with the next pen ready to be taken out. Press the white knob to get that one out, and then press the COLOR button again.

Take all four pens out this way, one by one.

WHERE TO PUT YOUR PENS

Just so you won't have to remember where you put the pens ... there's a little 'pen storage slot' under the printer.

First, take the plug out of the wall socket. Then **very carefully** turn the whole printer over. Underneath there are two slots for you to keep your second set of pens, and your empty pen tops in.

MORE PAPER! MORE PENS!

You can buy more pens and more paper from the same dealer you bought your printer from. Just ask for pens and paper for the Aquarius 4-color Printer.

THE COMPUTER CONNECTION SECTION

The next section tells you how to connect the printer up to your Aquarius computer. Do not do this until you have put in the pens and the paper.

If you bought the Aquarius 4-color Printer along with an Aquarius computer, learn how to use the computer **first**, **then** start learning about the printer! From here on, you have to know at least a little about the Aquarius computer.

If you're using a computer **other** than the Aquarius, then read page 55 , and then skip to page 15

Take the printer connecting cable (the one you got with the printer) and plug one end into the Aquarius computer's PRINTER socket (see the Aquarius "Guide to Home Computing" manual if you are in any doubt).

Plug the other end of the cable into the INPUT socket on the printer.

Now turn on the printer — it will go through its start-up routine. When that is finished, turn on the computer, and then press the computer's RTN key.

Your Aquarius 4-color Printer is now fully connected, and ready to go!

Notice that the printer didn't go to the start of the next line, as it would have done normally. 'chr$(10)' is called a **linefeed**, and it makes the printer move down a line.

REVERSE LINEFEED?

Press the PAPER button on the printer to get that last example out of the way so that you can see what happens next. Now try:

```
20 lprint chr$(11);

run
```

This time, the printer will move **up** a line. This is called a **reverse linefeed** ... just because it does the opposite of linefeed!

REPLY BY RETURN

Now try this one:

```
20 lprint chr$(13);

run
```

The printer will move to the **start** of the next line before it prints the second 'hello' (not like with a linefeed, where it didn't go to the start).

'chr$(13)' is called **carriage return**, because it makes the pen holder 'return' to the start of the next line.

Now open the top cover of the printer, and set the AUTO LINE FEED switch to the left (the end without the square). Try the experiment again — this time, the second 'hello' will be printed **over** the first one. What happened?

Well, lprint chr$(13); moves the pen to the **start** of the line, but it does not actually move the pen down a line (as an lprint on its own would). In fact, the lprint sends **two** things to the printer — a carriage return (chr$(13)) and a line feed (chr$(10)).

But when the AUTO LINE FEED switch is set to the right (the end with the square at it), the printer will always add a line feed when the computer sends it a carriage return. This is because some computers don't bother to send a line feed when you do an lprint.

That's why, when the AUTO LINE FEED switch is set to the right (the end with the square), sending a carriage return (CHR$(13)) to the printer does the same as an lprint — the AUTO LINE FEED actually stands for 'automatic line feed', and it adds a line feed to the carriage return automatically.

Turn the AUTO LINE FEED switch back to the right — the end with the square at it.

FORM FEED — just a formality

Now type:

```
lprint chr$(12)
```

The printer will push several inches of paper out. This is called a **form feed**, and what it does is to make sure that you start on a fresh piece of paper.

TURNING IT BLUE!

First, turn the printer off and back on again to make sure that the black pen is the one at the top of the pen holder. Then try:

```
lprint chr$(29);
```

This should make the pen holder change to the next color (which is blue). Try printing something to check that the color has changed to blue.

In fact, 'chr$(29)' does the same as pressing the COLOR button on the top of the printer — it makes it change to the next color. Press the

COLOR button, and print something to check that the color is now red.

Press the button again. This time, the color has changed to black. In fact, the color will go: black, blue, green, red, black, blue, ... so you can make the printer print in any color you want just by pressing the button (or lprinting chr$(29)) the right number of times.

SPECIAL CODES

Here is a list of the special codes that work in TEXT mode:

chr$(8)	backspace
chr$(9)	tab
chr$(10)	linefeed
chr$(11)	reverse linefeed
chr$(12)	form feed
chr$(13)	carriage return
chr$(29)	change color

In fact, there is another one:

chr$(18) enter PLOTTER mode — but you'll get to that later!

A REGULAR COLUMN

Now open the top of the printer, and take a look at the option switch at the far right. It is marked '80 40' and it should be in the '40' position.

This means that the printer will put 40 characters on each line (at the most). Push the switch to the '80' position, and close the cover.

Now try lprinting some stuff. You will find that the printer works just the same way, except that the letters are much smaller — in fact, there are now eighty of them to a line!

Open the cover and set the switch back to '40'. You can set it anywhere you like later, but the rest of the examples in this book use the '40' setting.

LLISTING YOUR PROGRAMS

Okay ... you now have a fully operational computer and printer! Let's go!

Now type:

```
new
```

— to clear the computer's memory. Now type in this program:

```
10 for i=32 to 127
20 lprint chr$(i);
30 next i
```

Then type:

```
list
```

— and check the program carefully. You can list the program on the printer, too. Type:

```
llist
```

(that's list with two 'l's). The program will be printed on your new printer. Now you can keep copies of all your programs for your files!

Now for something unusual. Press the COLOR button on the printer. The pen holder will rotate so that the next pen is at the top.

Type:

```
llist
```

— again for a copy of your program in blue! Press the COLOR button again to get it to green, then again for red, and a last time to get black again.

You can choose any color you want for printing.

CAST OF CHARACTERS

Now type:

```
run
```

The program will show you on the printer, all of the possible characters that the printer can print in what's called 'TEXT' mode (there are other modes, and a lot more characters).

What the printer prints should look something like this:

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
HIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmno
pqrstuvwxyz{|}~■
```

You will be using the lprint command and the chr$ function a lot with your new printer — so it's worth looking them up in your Aquarius computer manual. 'lprint' is on page R28, and page R33. 'chr$' is on page R42.

As well as printing any text that you want it to, just by using the lprint command, your printer can be sent special commands using the chr$ function.

Try these examples ...

BACKSPACE — makes cents, doesn't it?

Type:

```
new
```

— to clear the computer's memory, then put in this program:

```
10 a=15.23
20 lprint "$";a;"c";
```

Now type:

```
run
```

— to see what the program does. First, it will set the variable a to 15.23 (which, in fact, is going to be 15 dollars and 23 cents).

Then it prints a '$' sign, then the value of variable a (which is 15.23), then a little 'c'. Now, you can't use a '¢' sign, because the printer hasn't got one (in this mode).

The result looks something like this:

```
$ 15.23c
```

So a little 'c' is the best you can do ... but is it?

Add these two lines to the program (just type them in):

```
30 lprint chr$(8);
40 lprint "/"
```

Then type:

```
run
```

— to get this result!:

```
$ 15.23¢
```

What the two extra lines (lines 30 and 40) do is to print a chr$(8), which moves the printer **backwards** one space, then print the '/' **over** the 'c' to give the cents sign.

Printing chr$(8) makes the printer **backspace**. It moves it back one character so that you can type **over** what was already there. This is very useful for making special characters, like '¢'.

JUST A TAB HERE AND THERE ...

Press the PAPER button to push some paper out of the top of the printer, then type:

```
new
```

— to clear the computer's memory again.

Now put in this program:

```
10 lprint "A";
20 lprint chr$(9);
30 lprint "A";

run
```

The printer will print the first 'A', then the chr$(9) will make it move along a bit, then it will print the second 'A'. So the chr$(9) makes the printer move along — but it's more clever than that.

Change line 10 to this (just type it in):

```
10 lprint "AAA";

run
```

The printer will print the first 'AAA', then move along **to the same place as before**, then print the next 'A'.

The chr$(9) is called a **tab**, and it makes the printer move to the next pre-set 'tab position'. The tabs are set at positions 9, 17, 25, ... and every eight positions after that.

LINE FEED — not at the zoo!

Now type:

```
new

10 lprint "hello";
20 lprint chr$(10);
30 lprint "hello"

run
```

The first 'hello' will be printed at the start of the line, then the printer will move down a line, and the next 'hello' will start just under the end of the first one.

NOTES

CHAPTER 4

MIXED AND GRAPHIC MODES

A LITTLE MIX-UP

Open the printer cover again and look at the left-hand switch. This is called the 'mode' switch. It chooses the printer's character set (and other things). Set it to the middle position — MIXED.

This position gives much more characters than the TEXT position (all the text characters 'mixed' with a lot of 'graphics' ones) — but less of the 'control codes' (like 'backspace' and 'form feed') that you've just been using.

In fact, here are the control codes that **will** work in the MIXED mode:

chr$(9)	tab
chr$(10)	linefeed
chr$(13)	carriage return

MORE CHARACTERS!

Now for the good news — there are a lot more characters that you can use in MIXED mode. This program will produce a list of all of them (it's a little complicated, so make sure that you check it before you type run).

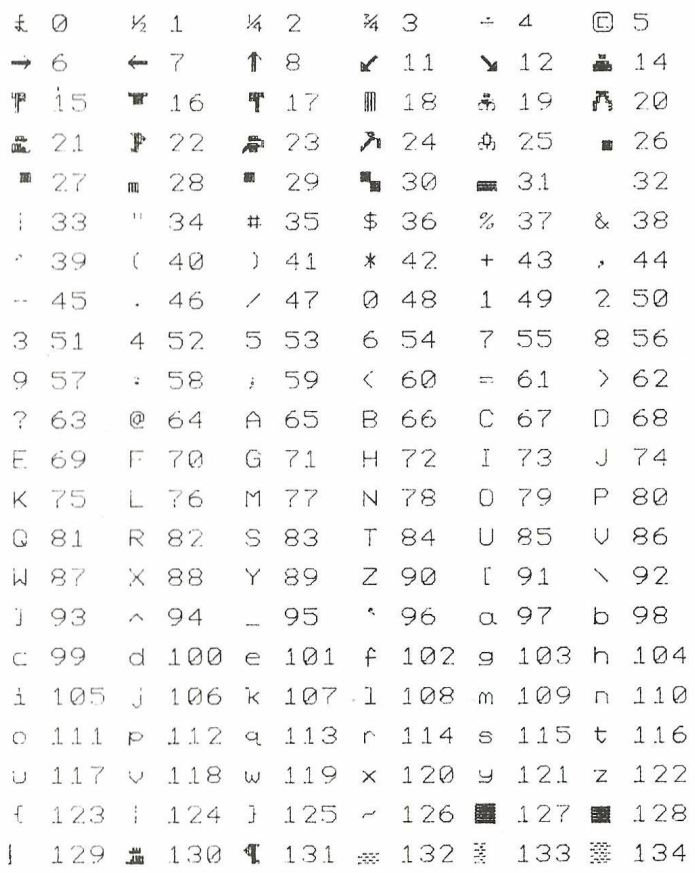
```
new

10 for i=0 to 255
20 if i=9 or i=10 or i=13 then
goto 80
30 lprint chr$(i);i;" ";
40 if i  10 then lprint "   ";
50 if i  100 then lprint "  ";
60 j=j+1
70 if j/6=int(j/6) then lprint
80 next i

list
```

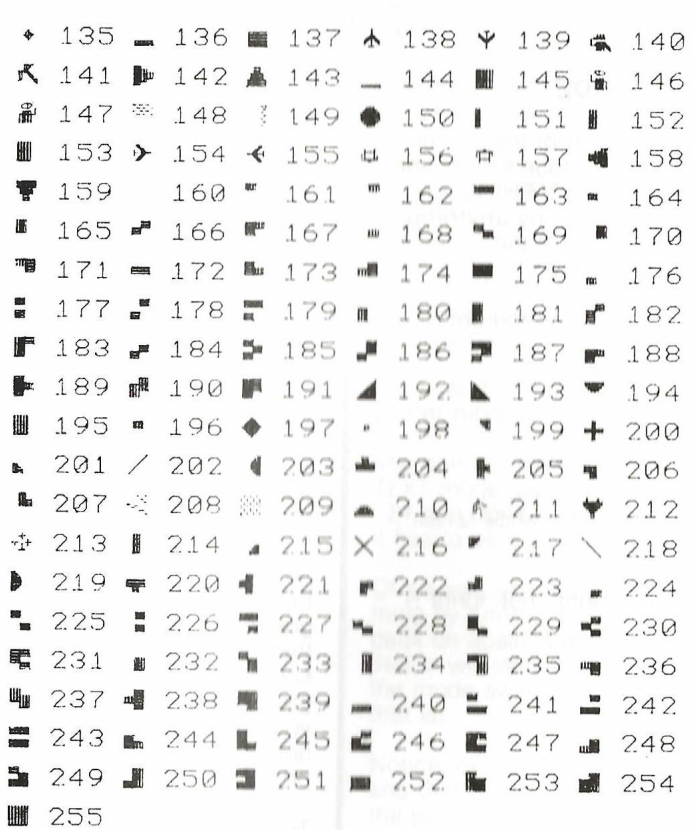
— now check the program carefully, then type:

```
run
```

You will get a complete list of all of the MIXED mode characters, plus the chr§ numbers that will produce them. Now you can call any of these characters from your programs (when the mode switch is set to MIXED, of course).

The list looks like this:




135 136 137 138 139 140
141 142 143 144 145 146
147 148 149 150 151 152
153 154 155 156 157 158
159 160 161 162 163 164
165 166 167 168 169 170
171 172 173 174 175 176
177 178 179 180 181 182
183 184 185 186 187 188
189 190 191 192 193 194
195 196 197 198 199 200
201 202 203 204 205 206
207 208 209 210 211 212
213 214 215 216 217 218
219 220 221 222 223 224
225 226 227 228 229 230
231 232 233 234 235 236
237 238 239 240 241 242
243 244 245 246 247 248
249 250 251 252 253 254
255

And that's about it for MIXED mode — there's really not much more to say about it!

GRAPHICS MODE

Now open the cover of the printer again, and set the mode switch (the one on the left) to GRAPHICS. In this mode, you can copy **anything** that's on the screen of the computer — it's easy.

First, type in this little program:

```
new

10 for i=20 to 30
20 print chr$(i);
30 next i
40 print
50 print "I can copy the whole screen!"
```

(notice that it's 'print', not 'lprint'!)

```
list

run
```

Now to produce a copy of the whole thing, type in:

```
copy
```

— and sit and watch (it takes a couple of minutes) which the printer produces an **exact** copy of whatever is on the screen.

This means that you can make up forms, graphs, or whatever you want on the screen **first**, and then, when you are sure that they are right, just print them with a single command!

If you want to do that, make sure that you put the COPY command **inside** a program. That way, what's on the screen will be copied without the word 'COPY' being printed.

So if you want to use your Aquarius to make up standard forms or other graphics, first write the program that will put the form onto the screen. When you have the program 'debugged' and working to your satisfaction, you can simply add a line at the end of the program that says COPY.

Then when you run the program, the last thing it will do will be to produce a copy of the screen on your 4-color printer.

The GRAPHICS mode is really only meant for copying the screen — you can send things to the printer using lprint while it is in the GRAPHICS mode, but it doesn't work real well ... try it if you like, and see.

Here's a little reminder of the BASIC commands that you can use with the printer in each mode:

Mode	BASIC commands
TEXT	lprint, llist
MIXED	lprint, llist
GRAPHICS	copy

CHAPTER 5

LINES, LINES AND MORE LINES

(Draw, Home, Move, Color, Line type)

A FIENDISH PLOT — getting into plotter mode

Now for the most exciting mode of them all — and it's not even marked on the switch!

Open the cover and set the mode switch (the one on the left) all the way back to TEXT — that's the position on the right.

Now you're going to turn this little printer into a powerful 'plotter' — and all at the touch of a few keys!

Type this:

```
lprint chr$(18)
```

The printer should give a little 'click' (it doesn't matter if you missed it). Now type:

```
lprint "M500,0,I"
```

The pen holder will move slowly to the middle of the paper — it just became a 'plotter'!

If it **didn't** work, then:

☐ Type the two lines again — maybe you made a mistake. Notice that the 'M' and 'I' in the second line must be **capitals** — use the shift key.

☐ Open the top of the printer, and make sure that the mode switch (the one on the left) is set to the TEXT position. This is the position that you have to use to get into the 'plotter' mode.

☐ Turn the printer off, wait a few seconds, then turn it on again. When it is ready, try the two lines again.

Now you know how to turn your **printer** into a **plotter**. When it is in the plotter mode, it cannot be used for printing text in the normal way.

For example, llist will **not** work in plotter mode.

You can get the printer back into TEXT mode just by typing in: lprint "Z" (but don't do it yet). Notice that it has to be a capital 'Z'.

Of course, you can do the same thing by turning it off, and then back on again. Every time you do that, it will start in TEXT mode (if the mode switch is set to TEXT, that is).

Notice, by the way, that the PAPER and COLOR buttons don't work in the plotter mode.

STARTING A NEW SESSION

In the next few chapters, you're going to be using the printer in plotter mode a lot.

Now, you probably won't want to work your way through the whole of that in one session ... so here's what to do.

If you're not going to be using the printer for a couple of days, take the pens out and put the caps on them. Then turn the printer and the computer off.

When you are ready to start again, turn the printer and the computer on, (put the pens back in if you took them out), then type:

```
lprint chr$(18)
lprint "M500,0,1"
```

If all is well, the pen will move to the middle of the paper. If it doesn't, then type the two lines again.

IN COMMAND — plotting commands

Now you know how to get into and out of plotter mode, it's time for a few words about how you're going to control the plotting!

All plotter commands are like the ones you just used — they're just an lprint of something to the printer. The reason why what you send **isn't** just printed normally is that you have put the printer into plotter mode.

So anything that you lprint will be looked at by the printer in a different way.

Plotting commands are just lprints, but what you lprint makes a big difference. There are thirteen different plotter commands (they're all easy), and each of them is a single letter, followed by one or two numbers (separated by commas). For example, when you sent "M500,0" the printer took a look at the 'M' at the start and said "Aha! This is a Move command"!

Each command has its own letter — 'M' for "Move", 'Z' for "Return to TEXT mode".

The fourteen commands are A, H, I, D, J, M, R, L, C, P, S, Q and Z, but don't worry — you're going to find out about them one at a time!

Here's a little reminder of the BASIC commands that you can use with the printer in each mode:

Mode	BASIC commands
TEXT	lprint, llist
MIXED	lprint, llist
GRAPHICS	copy
plotter	lprint

D for DRAW, H for HOME

Type this:

```
lprint "D200,200"
```

The printer will draw a diagonal line — it just became a plotter!

To move the pen back to the starting point, type:

```
lprint "H"
```

'H' stands for "Home", and it's a very useful command. It moves the pen back to where it started from (called the 'origin') without drawing a line.

The 'D' command tells the printer to "Draw". So 'D200,200' says "Draw a line from here (the origin) to a place 200 units to the right and 200 units up from the origin."

Let's try another one:

```
lprint "D100,400"
```

This time, the printer will draw a line to the place 100 units to the right, and 400 units up from the origin. Type this to get the pen back to the origin:

```
lprint "H"
```

How big is a 'unit'? Well, actually it's a tenth of a millimeter. The paper is about 1000 unit wide — so 400 units is about half the width of the paper.

What if you want to draw a line from somewhere other than the origin? Simple. Try this:

```
lprint "D400,100"
lprint "D100,300"
```

The first command makes the printer draw a line from the origin to somewhere near the right-hand edge of the paper — and the second command makes it draw a line from **there** to another point.

The 'D' command tells the printer where to draw by giving it two numbers — the first number tells it how far to the right of the origin, and the second tells it how far up from the origin.

So the second line in this example ended up at the point 100 to the right and 300 up **from the origin**.

Get rid of all these lines so you can see what's going on ... type this:

```
lprint "H"
```

— to move back to the origin, then take hold of the end of the paper, and pull some out to get rid of the lines.

The printer won't be able to tell that you pulled out the extra paper, so it will still think that it's at the origin for the next example (sneaky).

THE LEFT HALF

Now you will probably have noticed that all of the lines you've drawn so far are on the right half of the paper. This is not much use if you want to draw on the left half too!

Type this:

```
lprint "D-300,200"
```

— the printer will draw a line **left** of the origin. The '-' before the 300 told it that you wanted it to draw to a point 300 units to the **left**.

You can get the printer to draw **down** from the origin, too. Type this:

```
lprint "H"
```

— to get back to the origin, and then:

```
lprint "D-300,-200"
```

— to draw **down** and **left** of the origin.

Now type:

```
lprint "H"
```

— and then take hold of the top of the paper and pull some out of the printer so that you can see what's going on next.

LITTLE BOXES

Let's quit the learning for a minute or two and have some fun! Try this little program:

```
new

10 lprint "H"
20 input "Size ";s
30 lprint "D";s;",";0
40 lprint "D";s;",";-s
50 lprint "D";0;",";-s
60 lprint "D";0;",";0
70 lprint "H"
```

Before you do anything, read these important messages about taking care of your printer:

☐ Inside the printer is something called the 'pen holder' — a white plastic piece which will hold the pens. NEVER move the pen holder with your fingers. A good idea is never to even TOUCH the pen holder. It is VERY delicate.

☐ NEVER turn the printer on unless it has paper in it.

☐ NEVER use the printer unless it has four pens in it.

☐ NEVER use the printer when one of its pens is dry.

☐ Take the pens out and put the caps on them when you are not going to be using the printer for a couple of days ... otherwise the pens will dry out.

☐ NEVER try to use other types of pen in the printer. You can get new pens from the place where you bought the printer.

Okay, now that the ground rules have been laid ... let's go!

NOTES

CHAPTER 3

PRINTING TEXT

LET'S PRINT!

Open the top of the printer and make sure that the option switch on the left is pushed all the way to the right — to the TEXT position.

When the switch is in this position, the printer works just like a normal computer printer, except of course that it can write in four colors!

You can send the printer things to print by using the 'lprint' command of your Aquarius computer (see page R28 of your Aquarius computer manual "Guide to Home Computing").

The 'lprint' command on the Aquarius (and on most other computers) sends things to the printer for printing.

Try this:

```
lprint "hello"
```

The printer should print something like this:

```
hello
```

If it did, then all is well, and you can go on with the examples here.

But if it **didn't** work, then try these steps to find the problem:

☐ Try typing the line again — maybe you made a typing error!

☐ Check the green power indicator lamp on the top of the printer is on. This is to make sure that it is plugged into the wall socket, and that it is turned on.

☐ Turn the printer off, and then back on again. It should go through its 'start-up' routine (drawing four colored circles). If the power indicator lamp comes on, but the printer **doesn't** go through its routine, then it's not working right — get in touch with your dealer.

☐ If it **does** go through the routine, then take the printer connecting cable out and put it in again, closely following the instructions starting on page 13 . Then try the lprint again.

☐ If that didn't work, then check that the option switches are set according to the instructions on page 5 (if you do not have an Aquarius computer, see page 55 instead). Then try the lprint again.

☐ If it **still** doesn't work, then either your printer, your connecting cable, or your computer is not working right — take them all to your dealer so that he can check them for you.

```
list

run
```

The program will ask you for a size — put in a number from 1 to 400. When you press RTN, it will draw a square of the size that you told it to!

After you have done that a few times, figure out how the program works (it's not difficult). Then try to work out what will happen if you answer -300! Then try it!

Stop the program (by pressing and holding the CTL button on the Aquarius and pressing the 'C' key on the Aquarius at the same time), then clear the paper by typing:

```
lprint "H"
```

— and pulling some more out by hand to get rid of what you've just done.

M for MOVE

Are you ready for another command? Yes? Right! Type this:

```
lprint "D450,450"
```

— to draw a line to near the right-hand edge of the paper, then:

```
lprint "M400,300"
```

— to move **without drawing a line**, then:

```
lprint "D200,100"
```

— to draw a line from where you were to another point. Type:

```
lprint "H"
```

You can see that, using the 'D' ('Draw') and 'M' ('Move') commands, you can draw just about anything you want ... but don't go away. There are lots more commands that will let you draw things you didn't even **think** of yet!

Just how many units can the pen move across the page? Well, it can go up to 999 units up or down from the origin, and there are 960 units **across** the paper.

So far, you've got:

'D'	"Draw"
'M'	"Move"
'H'	"Home"

Draw and move need two numbers after them, to tell the printer where to draw or move **to**. Home doesn't need any numbers after it.

C for COLOR

What about color? That's very easy ... try this one:

```
lprint "C1"
```

— the color will change to blue. Just like that!

Try it out:

```
lprint "D200,-200"
```

Now for another color:

```
lprint "C2"
lprint "D400,-400"
```

Now back to blue:

```
lprint "C1"
lprint "D400,0"
```

Type:

```
lprint "H"
```

and pull some more paper out of the printer by hand.

You can change to any color you want just by using the 'C' (for "Color") command, and these numbers:

Ø	black
1	blue
2	green
3	red

L for ... dots!

The printer can't only draw lines in different colors — it can draw **dotted** lines, too!

The 'L' command lets you choose the 'Line type' — anywhere from a solid line to one with long dashes in it.

```
lprint "H"
lprint "L2Ø"
lprint "D4ØØ,-4ØØ"
```

Whatever lines you ask the printer to draw from now on (until you give it another 'L' command), it will draw in a dotted line.

If you want to turn the dots off (and make it a normal line again), just type: lprint "LØ" — that's an 'L' and a zero 'Ø'. The number that you put after the 'L' tells the printer what **size** of dots to use. Try this one:

```
lprint "L6Ø"
lprint "D-4ØØ,-4ØØ"
```

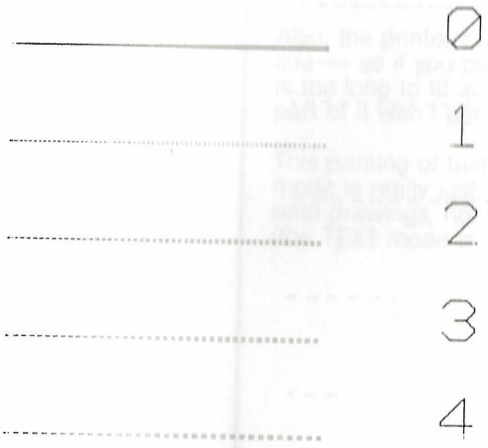
The size of the dots can be set anywhere from 1 (which is for dots so small they almost look like a solid line) to 255 (which is for dashes about an inch long).

The diagram here will give you some idea of the size of the dots for fine lines.

Here are the commands that you've got so far:

'D'	"Draw"
'M'	"Move"
'H'	"Home"
'C'	"Color"
'L'	"Line type (dotted)"

But there are more to come ... this is a pretty clever printer, you know!



5

6

7

8

9

10

11

12

13

14

15

16

17

18

19

20

CHAPTER 6

PLOTTING TEXT

(Print text, Size, Direction (Q), example program)

STARTING A NEW SESSION

In the next few chapters, you're going to be using the printer in plotter mode a lot.

Now, you probably won't want to work your way through the whole of that in one session ... so here's what to do.

If you're not going to be using the printer for a couple of days, take the pens out and put the caps on them. Then turn the printer and the computer off.

When you are ready to start again, turn the printer and the computer on, (put the pens back in if you took them out), then type:

```
lprint chr$(18)
lprint "M500,0,1"
```

If all is well, the pen will move to the middle of the paper. If it doesn't, then type the two lines again.

P for PRINT TEXT

Now for a little surprise. First, type this:

```
lprint "H"
```

— and pull some paper out of the printer by hand. Then type:

```
lprint "S3"
```

You'll find out what it means a little later. Now types:

```
lprint "Phello"
```

The printer will put the word 'hello' onto the paper ... even though it's still in plotter mode!

But there is one little problem. None of the usual 'control codes' (like line feed or backspace) will work in this mode.

Also, the printer can't take a new line — so if you put in a word that is too long to fit across the paper, part of it won't get printed.

This printing of text in the plotter mode is really just for putting labels onto drawings, not for printing text (the TEXT mode is for that).

Anything that you put after the 'P' (for "Print text") will be printed out. Here is a complete list of the possibilities:

32	! 33	" 34	# 35
$ 36	% 37	& 38	' 39
(40	) 41	* 42	+ 43
, 44	- 45	. 46	/ 47
0 48	1 49	2 50	3 51
4 52	5 53	6 54	7 55
8 56	9 57	: 58	; 59
< 60	= 61	> 62	? 63
@ 64	A 65	B 66	C 67
D 68	E 69	F 70	G 71
H 72	I 73	J 74	K 75
L 76	M 77	N 78	O 79
P 80	Q 81	R 82	S 83
T 84	U 85	V 86	W 87
X 88	Y 89	Z 90	[91
\ 92	] 93	^ 94	_ 95
` 96	a 97	b 98	c 99

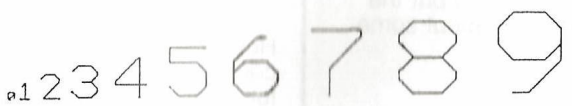
d 100 e 101 f 102 g 103
h 104 i 105 j 106 k 107
l 108 m 109 n 110 o 111
p 112 q 113 r 114 s 115
t 116 u 117 v 118 w 119
x 120 y 121 z 122 { 123
¦ 124 } 125 ~ 126 ▒ 127

S for SIZE

The 'S' command that you used a minute ago sets the "Size" of the text that is printed. 'S3' gives letters that are about 40 units high (that's around one sixth of an inch).

You can have sizes that are anywhere from 'S0' (which is the same size as the 80-column setting in text mode ... pretty small at about four hundredths of an inch high!) to 'S9', which is nearly half an inch high.

Here is a useful guide to the sizes you can get:



Q for ... sideways and upside down!

Now the printer is going to do something amazing ... it's going to write sideways and even upside down!

The 'Q' command lets you set the "Direction" of the text printing.

First, type:

```
lprint "H"
```

and pull some paper out by hand. Then type:

```
lprint "Phello"
lprint "H"
lprint "Q1"
lprint "Phello"
lprint "H"
```

That's pretty useful for charts and graphs, where you have to put the label up one side. How about some more:

```
lprint "Q2"
lprint "Phello"
lprint "H"
lprint "Q3"
lprint "Phello"
lprint "H"
```

Pull some more paper out by hand so you can see what you've just printed. Here are the codes that the 'Q' command will work with:

'Q0' normal (left to right)
'Q1' bottom to top
'Q2' upside down
'Q3' top to bottom

The commands you know so far are:

'D'	"Draw"
'M'	"Move"
'H'	"Home"
'C'	"Color"
'L'	"Line type (dotted)"
'P'	"Print text"
'S'	"Size of text"
'Q'	"Direction of text"

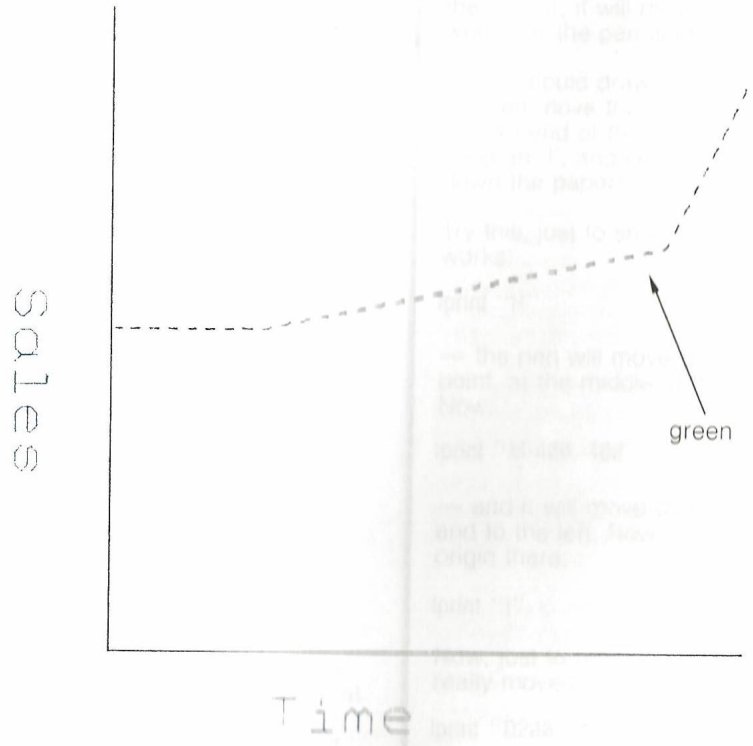
PUTTING IT ALL TOGETHER — an example of a chart

How about putting some of those commands to work, to produce a full-color high-technology management chart!

Put in this program:

```
new

10 lprint "C0"
20 lprint "H"
30 lprint "L0"
40 rem now draw the axes
50 lprint "M-400,-400"
60 lprint "D400,-400"
70 lprint "M-400,-400"
80 lprint "D-400,400"
90 rem now the labels — in blue
100 lprint "C1"
110 lprint "M-200,-470"
120 lprint "S3"
130 lprint "Q0"
140 lprint "PTime"
150 lprint "Q1"
160 lprint "M-440,-200"
170 lprint "PSales"
180 rem now the line — in dotted green
190 lprint "C2"
200 lprint "L10"
210 lprint "M-400,0"
220 lprint "D-200,10"
230 lprint "D0,100"
240 lprint "D200,200"
250 lprint "D400,400"
260 lprint "H"
```

The chart should look like the one here:



NOTES

CHAPTER 7

THE LAST OF THE COMMAND

(Change origin (I), All normal (A), Draw like (J), Move like (R), Questions and answers, Command quick-reference list)

STARTING A NEW SESSION

In the next chapters, you're going to be using the printer in plotter.

Now, you probably won't want to work your way through the whole chapter in one session ... so here's what to do.

If you're not going to be using the printer for a couple of days, take the pens out and put the caps on them. Then turn the printer and the computer off.

When you are ready to start again, turn the printer and the computer on, (put the pens back in if you took them out), then type:

```
lprint chr$(18)
lprint "M500,0,I"
```

If all is well, the pen will move to the middle of the paper. If it doesn't, then type the two lines again.

I want to move the origin

Up to now, the 'origin' has been in the middle of the paper — but what if you wanted to move it? You see, you can only draw 999 units up or down from the origin — so there might be a time when you want to draw something **really** long (longer than 1998 units), so you would want to move the origin down on the paper to give you the extra room.

The command for this is 'I'. Just 'I' on its own. When you send this to the printer, it will move the origin to wherever the pen is at present.

So you could draw what you had to, then move the pen to the bottom end of that piece of paper, send an 'I', and keep on drawing down the paper!

Try this, just to show how it all works:

```
lprint "H"
```

— the pen will move to its usual point, at the middle of the paper. Now:

```
lprint "M-400,-400"
```

— and it will move down the paper, and to the left. Now to set the new origin there:

```
lprint "I"
```

Now, just to make sure that it has really moved:

```
lprint "D200,200"
```

— will move it away, and then:

```
lprint "H"
```

— will move it back to its **new** origin at the left of the paper.

A for ALL NORMAL

There's an even more useful command ... 'A'. When the last program finished, the printer was still set up to draw dotted green lines. The next time you want to just draw something in solid black lines, you would have to tell the printer to change the color, then the line type, then the character size, ... and so on.

But there's an easier way. When you send 'A', the printer will automatically be set to:

Color ... black
Character size ... 0 (the smallest)
Direction of text ... left to right (normal)
Line type ... 0 (solid)
Origin ... at the left of the paper

The origin will be set to the left-hand edge of the paper, opposite wherever the pen is at the time.

Try it:

```
lprint "D200,-200"
lprint "A"
lprint "D300,-300"
```

The second line that you draw will be a black solid one — just like that!

Now you can understand how the command you sent at the start of this session works. Do it now, to set the origin back to the middle of the page:

```
lprint "M500,0,1"
```

J and R for special occasions

There are only a couple more commands to go — then you will know them all.

You already know the 'D' and 'M' commands — for "Draw" and "Move". There are two other commands that are very similar to those ones, but with one important difference.

The 'J' command is just like the "Draw" command. But with the 'D' command, the two numbers after the 'D' tell the printer the point to draw to by telling it the distances from the 'origin'.

The 'J' command tells the printer to draw a line, too. But it tells it where to draw to by telling it **distances from the present pen position.**

Try this:

```
lprint "H"
```

— pull some paper out by hand.

```
lprint "D-200,-300"
```

Now you have a line down and to the left from the origin (the origin is now in the middle of the paper, at the top of the line, remember).

```
lprint "J100,100"
```

The printer will draw a line which goes 100 units up, and 100 units to the right **of the point it started from.** The 'J' command tells the printer to draw a particular **line,** rather than **to a particular point.**

So the 'J' command can be used when you want to have a shape stored, and then print it out anywhere you want. You move the pen to the point where you want the shape to start, and then give the printer some 'J' commands to draw the shape there. It doesn't matter where it started — the shape will always be the same.

The 'R' command moves the pen, just like the 'M' command, except that it moves it to a point at a given distance **from where the pen started.**

Type:

```
lprint "H"
```

— and pull some more paper out by hand.

GET A LITTLE CROSS

The 'R' and 'J' commands will be a lot clearer when you have tried this little example:

```
new

10 lprint "M200,200"
20 gosub 100
30 lprint "M-200,-200
40 gosub 100
50 lprint "M200,-200"
60 gosub 100
70 lprint "H"
80 stop
100 lprint "J100,100"
110 lprint "R-100,0"
120 lprint "J100,-100"
130 return
```

— if you don't remember what 'gosub' and 'return' are all about, go back to your "Guide to Home Computing" and read Chapter 7.

```
run
```

The subroutine at line 100 draws a cross, starting at wherever the pen is when the subroutine is called. All the program does is to move the pen around, and use the subroutine to draw three crosses at different points on the paper.

This would be very difficult to do if you didn't use the 'R' and 'J' commands — just for the heck of it, try to figure out how to do it using just 'M' and 'D'!

SOME QUESTIONS ... AND ANSWERS!

What happens when I try to draw off the edge of the paper?

Well, you can't use a number greater than 999 in any of the move or draw commands — the printer will just give up, and go back into normal text mode.

But, if you use numbers less than 999 and **still** go over the edge (like if the origin is near the edge already), then here is what will happen:

The printer will move the pen to the edge, and pretend to draw over the edge — it will move the paper up and down as if it was really drawing, but the pen will not be on the paper.

Can I put more than one command into one 'lprint'?

Yes, just end each command with a comma. Like this:
'D100,100,M200,200,D300,300'.

Notice that this won't work with the 'P' command — the printer will just **print** the comma and keep on going!

Also, you can use the same command again and again by just giving new numbers:
'D100,100,200,200,300,300'
is the same as
'D100,100,D200,200,D300,300'.

What happens when I put a semi-colon (;) at the end of an 'lprint'?

When you are giving the printer commands, you can continue on the next 'lprint' if you put a semi-colon at the end of the line. So:

```
lprint "D100,100,";
lprint "200,200,300,300"
```

— is the same as:

```
lprint "D100,100,200,200,300,300"
```

Again, this doesn't work with the 'P' command.

How do I use variables in printer commands?

Using variables is easy ... as long as you remember where to put the commas in. For an example, see the program on page 27.

IN TOTAL COMMAND

Now you know all the commands that there are to know ... now you know it all!

Here are the commands:

'A' "All normal"	Sets color to black, character size to 0, text direction to 'left to right', line type to solid, and origin to left of the paper
'H' "Home"	Moves the pen back to the origin
'I' "Is the origin"	Sets the origin to where the pen is now
'C' "Color"	Sets the color: 0 is black 1 is blue 2 is green 3 is red
'L' "Line type"	Sets the line type to anywhere from 0 (solid) to 253 (very long dashes)
'P' "Print text"	Prints whatever comes after as text
'S' "Size"	Sets the size of the text from 0 (smallest) to 9 (largest)
'Q' "Direction"	Sets the direction of the text: 0 is normal 1 is bottom to top 2 is right to left 3 is top to bottom
'D' "Draw to"	Draw a line to this point
'M' "Move to"	Move the pen to this point without drawing

'J' "Draw this much"	Draw a line like this
'R' "Move this much"	Move the pen like this without drawing
'Z' "Finished"	Go back into normal TEXT mode

GOOD PRACTICE

What's the best way to go about using the plotter mode from a BASIC program? Here are a couple of lines that you should put at the start of each program you write:

```
10 lprint chr$(18); "A"
20 lprint "M500,0,I"
```

— the first line sets the printer into plotter mode (or, if it's already set to plotter mode, does no harm), and initializes the printer.

The second line moves the pen to the middle of the paper (change the numbers if you don't want it there) and then sets the origin.

It's a good idea to set up all of the things that you want set in the program (for example, the letter size, pen color, and so on) so that every time the program is run, these things will be set automatically to where you want them. Don't depend on your having to set them one by one from the keyboard before you run the program.

Also, put this line at the end of each program:

```
1000 lprint "Z"
```

— to set the printer back into TEXT mode. This will be very useful if you want, for example to llist the program just after you run it. It's a good habit to get into.

Good hunting!

NOTES

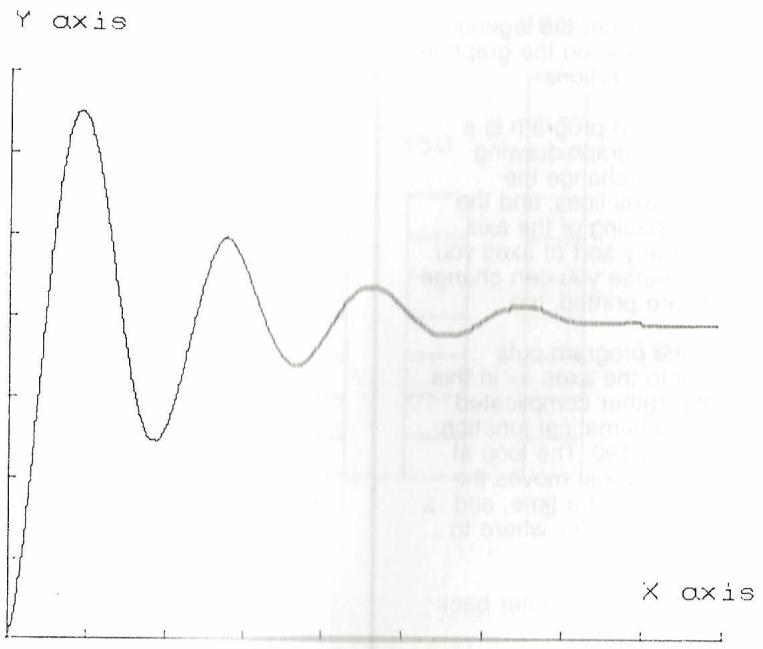
CHAPTER 8

SOME USEFUL SAMPLE PROGRAMS

Here are some sample programs which will let you do some useful things with your printer right away ... and give you some ideas for programs of your own!

Line 10 sets the printer into graphics mode (for all these programs, the mode switch (the one on the left) should be set to TEXT). Line 20 sets the printer up, moves the paper up a bit, and sets the origin.

GRAPH



Line 30 draws the main lines of the axes.

The two loops 40 — 60, and 70 — 90, put the marks on the axes, using the J command. The loops move points evenly spaced along the axis lines, and then use the J command to draw a little mark from wherever the pen has been taken to by the loop.

Lines 100 to 140 print the legends 'X axis' and 'Y axis' on the graph in the appropriate positions.

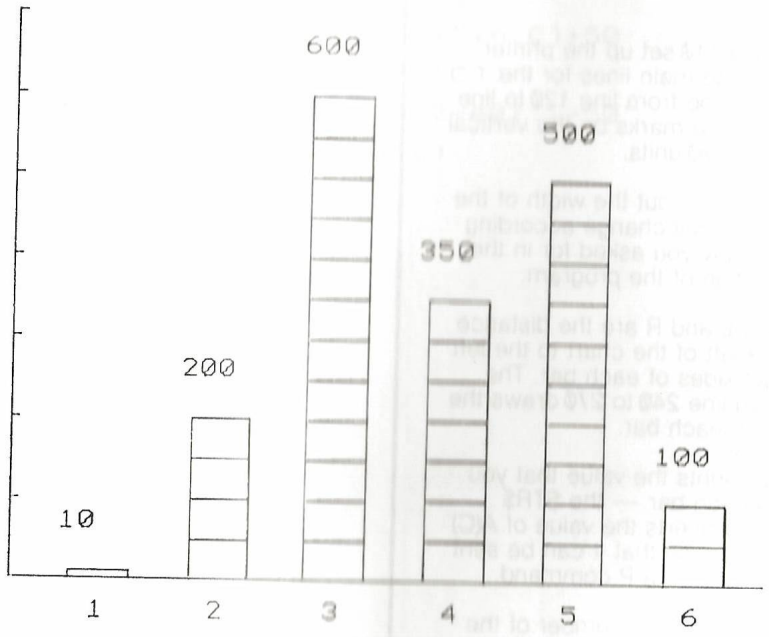
Up to line 150, the program is a general-purpose graph-drawing routine. You can change the lengths of the axis lines, and the number and spacing of the axis marks, to get any sort of axes you line. And of course you can change what words are printed, too.

The rest of the program puts something onto the axes — in this case, it's the rather complicated (but pretty) mathematical function in lines 170 thru 190. The loop at lines 160 and 210 just moves the pen along 5 steps at a time, and line 200 tells the printer where to draw to next.

Line 220 just sets the printer back into text mode.

```
10 LPRINT CHR$(18)
20 LPRINT "A,M0,-700,I"
30 LPRINT"D0,700,H,D900,0"
40 FOR I=100 TO 700 STEP 100
50 LPRINT"M0,";I;",J10,0"
60 NEXT I
70 FOR I=100 TO 900 STEP 100
80 LPRINT"M";I;",0,J0,10"
90 NEXT I
100 LPRINT "M0,750"
110 LPRINT"S1"
120 LPRINT"PY axis"
130 LPRINT "M800,50"
140 LPRINT"PX axis"
145 LPRINT "H"
150 REM Now put something on it
160 FOR I=0 TO 900 STEP 5
170 M=-I/200
180 N=I/30
185 R=300
190 Y=INT(400-400*EXP(M)*COS(N))
200 LPRINT "D";I;",";Y
210 NEXT I
220 LPRINT "M0,-200,Z"
```

BAR CHART



Lines 20 through 80 just get the information from the user (that's you).

You can have any number of bars in the chart, from 2 to 10, and you can give them heights from 0 to 700.

Lines 90 to 110 set up the printer and draw the main lines for the axes. The loop from line 120 to line 140 draws the marks on the vertical axis every 100 units.

Line 150 works out the width of the bars (which will change according to how many you asked for in the input section of the program.

Variables L and R are the distance from the left of the chart to the left and right sides of each bar. The loop from line 240 to 270 draws the stripes on each bar.

Line 290 prints the value that you gave to each bar — the STR$ function converts the value of A(C) into a string, so that it can be sent to the printer in a P command.

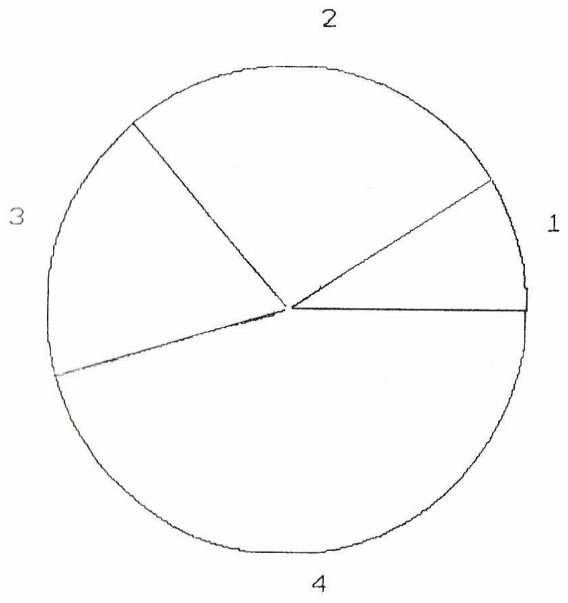
Line 300 prints the number of the bar in the middle ((L + R)/2 gives the middle of the bar).

Lines 330 and 340 lift the pen and set the printer back into text mode.

```
10 DIM A(10)
20 INPUT "How many columms (2 to 10) ";C
T
30 IF CT>10 OR CT<2 THEN GOTO 20
40 FOR C=1 TO  CT
50 PRINT  "Value for column ";C;" (0 to
700) ";
60 INPUT A(C)
70 IF A(C)<0 OR A(C)>700 THEN GOTO 50
80 NEXT C
90 LPRINT CHR$(18)
100 LPRINT "A,M0,-700,I,S1"
110 LPRINT "D0,700,H,D950,0"
120 FOR I=100 TO 700 STEP 100
130 LPRINT "M0,";I;",J10,0"
140 NEXT I
150 CW=450/CT
160 FOR C=1 TO CT
170 L=(C*2-1)*CW
180 R=C*2*CW
190 LPRINT "C";C-1
200 LPRINT "M";L;",0"
210 LPRINT "D";L;",";A(C)
220 LPRINT "D";R;",";A(C)
230 LPRINT "D";R;",0"
```

```
235 IF A(C)<50 THEN GOTO 280
240 FOR I=50 TO A(C) STEP 50
250 LPRINT "M";L;",";I
260 LPRINT "D";R;",";I
270 NEXT I
280 LPRINT "M";L-40;",";A(C)+50
290 LPRINT "P";STR$(A(C))
300 LPRINT "M";(L+R)/2-40;",-50"
310 LPRINT "P";STR$(C)
320 NEXT C
330 LPRINT "H"
340 LPRINT "Z"
```

PI CHART



Lines 20 to 90 get the information for the chart — the value for each segment can be any size, except that it must be greater than zero (of course!).

Lines 100 thru 150 divide all of the values by the total, so that each value in A( ) is the angle for that segment, and the values in S( ) are the starting angle for the segment.

Lines 160 and 170 set up the printer.

The subroutine at line 500 draws from the current pen position (whatever that happens to be at the time) to a point on the circumference of a circle with radius R. The point is at an angle TH around the circle (with TH = 0 giving the three-o'clock position, and the angle being in radians).

So lines 210 and 220 draw a line from the center of the circle to the circumference at the starting point of the segment. Then the loop between lines 230 and 250 draws the outside of the segment, moving in steps of 0.1 of a radian.

The lines from 260 to 310 draw the last part of the outside of the segment (which is difficult to arrange in the loop, and so must be done separately).

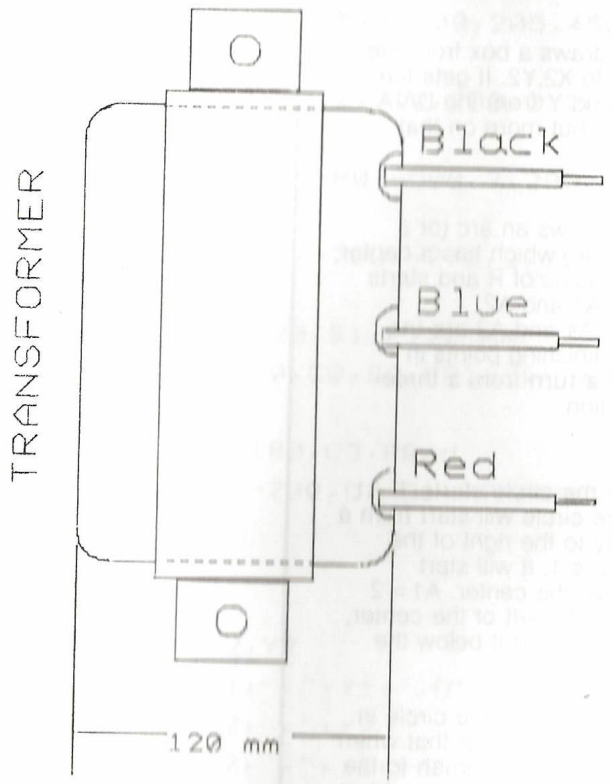
```
10 DIMA(10):PI=3.1419265
20 INPUT "How many segments (2 to 10)";C
T
30 IF  CT>10 OR CT<2 THENGOTO 20
40 FOR C=1 TO CT
50 PRINT "Value for segment ";C;" ";
60 INPUT A(C)
70 IF A(C)<0 THEN GOTO 50
80 T=T+A(C)
90 NEXT C
100 FOR C=1TO CT
120 A(C)=A(C)/T*2*PI
130 S(C)=ST
140 ST=ST+A(C)
150 NEXT C
160 LPRINT CHR$(18)
170 LPRINT "A,M450,-300,I,S1"
180 FOR C=1 TO  CT
185 R=300
190 LPRINT "C";C-1
200 LPRINT "H"
210 TH=S(C)
220 GOSUB 500
230 FOR TH=S(C) TO A(C)+S(C) STEP .1
240 GOSUB 500
```

Lines 320 thru 350 print in the segment number.

Lines 370 and 380 move the paper out, make sure that black pen is the one being used, and switch the printer back to text mode.

```
250 NEXT TH
260 IF C=CT THEN GOTO 300
270 TH=S(C+1)
280 GOSUB 500
290 GOTO 320
300 TH=0
310 GOSUB 500
320 TH=S(C)+A(C)/2
330 R=350
340 LPRINT "M";INT(R*COS(TH))-40;",";INT
(R*SIN(TH))
350 LPRINT "P";STR$(C)
360 NEXT C
370 LPRINT "M0,-400"
380 LPRINT "C0,Z"
390 STOP
500 REM subroutine to draw to a position
510 REM on the edge of the circle at an
520 REM angle of TH
530 LPRINT "D";INT(R*COS(TH));",";INT(R*
SIN(TH))
540 RETURN
```

ENGINEERING DRAWING



This program is not as complicated as it looks — but it is very useful, nonetheless.

Let's look at the subroutines first.

1000
This routine draws a box from the point X1,Y1, to X2,Y2. It gets the values of X and Y from the DATA statements ... but more on that later.

2000
This routine draws an arc (or a complete circle) which has a center of X1,Y1, a radius of R and starts and ends at A1 and A2 respectively. A1 and A2 are the starting and finishing points in **quarters of a turn** from a three-o'clock position.

Confusing?

A1 is where the circle starts. If A1 is 0, then the circle will start from a point directly to the right of the center. If A1 is 1, it will start directly above the center. A1 = 2 will start it to the left of the center, and A1 = 3 will start it below the center.

A2 gives the finish of the circle in the same way — except that when A2 is 4, the circle will **finish** to the right of the center. So setting A1 to 0 and A2 to 4 will give a complete circle.

```
10 P2=3.1416/2
20 LPRINT CHR$(18)
30 LPRINT "A,M450,-300,I"
40 READ F
50 ON F GOSUB 1000,2000,3000,4000,5000
60 GOTO 40
70 DATA 1,-100,-300,100,300
80 DATA 1,-70,-400,70,-300,1,-70,300,70,
400
90 DATA 2,0,-350,20,0,4,2,0,350,20,0,4
100 DATA 3,-160,280,-100,280,3,-160,-280
,-100,-280
110 DATA 3,160,-280,100,-280,3,160,280,1
00,280
120 DATA 4,"L7",3,-100,280,100,280,3,-10
0,-280,100,-280,4,"L0"
125 DATA 3,-200,-240,-200,240
130 DATA 3,200,240,200,210,3,200,190,200
,10
140 DATA 3,200,-10,200,-190,3,200,-210,2
00,-240
150 DATA 2,-160,240,40,1,2,2,-160,-240,4
0,2,3
160 DATA 2,160,-240,40,3,4,2,160,240,40,
0,1
```

The way in which the circle is drawn is very similar to that used in the PI CHART program earlier in this chapter — the only difference is that the step size will be larger for smaller circles.

If you look at line 2040 you will see that, R (the radius of the circle) increases, the step size will get less. This is to save time when drawing very small circles or arcs, which do not need a lot of steps.

3000
This routine draws a line, but in all other respects is the same at the routine at line 1000.

4000
This routine just takes a string from the DATA statements, and sends it to the printer.

5000
This routine stops the program.

MAIN PROGRAM
The part of the program in lines 40 thru 60 simply gets a value from the DATA statements (F), and uses it to determine which subroutine to send the computer to. Each subroutine will then read the appropriate data and act on it, drawing boxes, circles, lines, and so on, according to the data.

```
170 DATA 1,180,190,400,210,4,"C1",1,180,
-10,400,10
180 DATA 4,"C3",1,180,-190,400,-210,4,"C
0",1,400,-200,450,-195
190 DATA 1,400,-5,450,5,1,400,205,450,19
5
200 DATA 2,200,200,30,1,3,2,200,0,30,1,3
,2,200,-200,30,1,3
210 DATA 3,-200,-500,-80,-500,3,200,-500
,80,-500
220 DATA 3,-200,-550,-200,-270,3,200,-55
0,200,-270
230 DATA 4,"M-80,-520,S1,P120 mm"
240 DATA 4,"M220,220,C0,S2,PBlack",4,"M2
20,20,C1,PBlue"
250 DATA 4,"M220,-180,C3,PRed"
260 DATA 4,"M-250,-200,C2,Q1,PTRANSFORME
R",4,"Z",5
1000 REM box
1005 PRINT "box"
1010 READ X1,Y1,X2,Y2
1020 LPRINT "M";X1;",";Y1;",D";X1;",";Y2
1025 LPRINT "D";X2;",";Y2
1030 LPRINT "D";X2;",";Y1;",D";X1;",";Y1
1040 RETURN
2000 REM circle
```

For example, the DATA statement in line 70 will draw a box from —100,-300 to 100,300. This is the main body of the transformer.

This program will **just** fit into a standard Aquarius (without added RAM).

Of course, you don't have to use this program to draw transformers — it's the sort of program that's designed to be used in a wide variety of ways. The circle-drawing routine will be especially useful in the programs that you will develop for your 4-color printer.

```
2005 PRINT "circle"
2010 READ X1,Y1,R,A1,A2
2020 A1=A1*P2:A2=A2*P2
2030 LPRINT "M";X1+INT(R*COS(A1));",";Y1
+INT(R*SIN(A1))
2040 FOR A=A1 TO A2 STEP 10/R
2050 LPRINT "D";X1+INT(R*COS(A));",";Y1+
INT(R*SIN(A))
2060 NEXT A
2070 LPRINT "D";X1+INT(R*COS(A2));",";Y1
+INT(R*SIN(A2))
2080 RETURN
3000 REM line
3005 PRINT"line"
3010 READ X1,Y1,X2,Y2
3020 LPRINT "M";X1;",";Y1
3030 LPRINT "D";X2;",";Y2
3040 RETURN
4000 REM string
4005 PRINT "string"
4010 READ S$
4020 LPRINT S$
4030 RETURN
5000 REM stop
5005 PRINT "stop"
5010 STOP
```

CHAPTER 9

SWITCHES, TESTS AND OTHER COMPUTERS

(Option switches, Self-tests, Computers other than the Aquarius)

WHAT THE SWITCHES DO

The three 'option switches' under the cover of the printer let you to change the way the printer works.

For example, the MODE switch (at the left) can be set to:

TEXT (right): For printing normal text from the printer, with the most number of control codes available (see page 62 - 64).

The plotter mode can be entered by sending a chr$(18) to the printer while the MODE switch is in the TEXT position — plotter mode cannot be entered with the switch in any other position.

MIXED (middle): For printing text and graphics symbols (almost the full Aquarius graphics character set) — but with less control codes (see page 62 - 64).

GRAPHICS (left): For using the Aquarius COPY command — which copies whatever is on the screen

The AUTO LINE FEED switch (middle) has two positions:

The right-hand position (the one with the square): For automatically doing a line feed whenever the printer is sent a carriage return control code.

The left-hand position (the one without the square): For not doing an automatic line feed.

For Aquarius users, putting the switch in the right-hand position will give a blank line between each line of text. Putting it in the left-hand position will give lines of text that are not separated by a blank line.

WHEN YOU ARE LLISTING PROGRAMS, THE RIGHT-HAND POSITION OF THE AUTO LINE FEED SWITCH IS BEST, BECAUSE IT MAKES THE LISTING EASIER TO READ.

For computers other than Aquarius, the left-hand position may give lines that are on top of one another (with no paper movement between lines). The right-hand position is the best one to start with, and the left-hand position can be tried later.

The COLUMNS switch sets the number of characters in each line — 4Ø or 8Ø.

If in doubt, set all three switches all the way to the **right** to start with.

SELF-TEST — the printer's health guide

The printer has two handy 'self-tests' built into it. One happens every time you turn the printer on — it draws four circles (black, blue, green and red, and in that order).

When you have just fitted the pens, and turned the printer on, it's a good idea to check that these circles **are** in the right order — if they're not, then you didn't put the right pens into the right slots in the pen holder! Take them out and start again!

There is another self-test routine that the printer can do, too.

If you turn the printer off, and then press down and hold the PAPER button, and while you are holding it down, turn the printer on, it will go through its second self-test.

The printer will print the four colored circles, then it will print its whole character set (the one that is available in the GRAPHICS mode, in which it copies what's on the screen of the Aquarius).

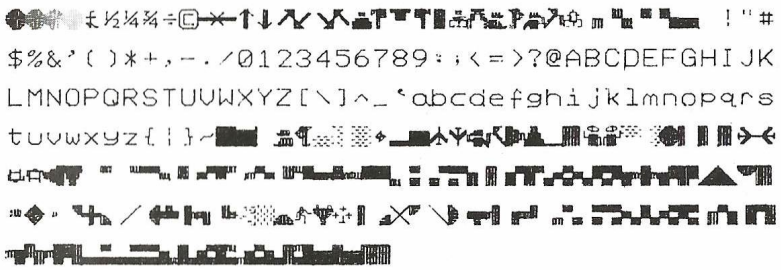
The position of the mode switch (see page 55) will not make any difference to what happens — but the positions of the AUTO LINE FEED and columns ('80 40') switches will.

If the AUTO LINE FEED switch is in the right-hand position (the one with the square), the printer will put a blank line between each line of the character set. If it is in the other position, there will be no blank lines.

If the columns ('80 40') switch is in the 80 position, the printer will print the character set in the smallest size available — 80 characters to the line. If it is in the 40 position, it will print in the larger size (40 to the line).

Use the second self-test to check that the printer is working correctly — in particular, it lets you check that the AUTO LINE FEED and columns switches are working right.

With the AUTO LINE FEED switch in the right-hand position (the one with the square) and the columns ('80 40') switch in the 40 position, the result of the second self-test should look like this:



COMPUTERS OTHER THAN THE AQUARIUS

If you own a computer other than an Aquarius, there are some points that you should note:

1) The GRAPHICS mode of the printer is designed only for the Aquarius computer, and has no equivalent in most other computers.

However, you may be able to use it with a little programming. It will give you the whole Aquarius character set.

2) Set the AUTO LINE FEED switch to the right-hand position (the one with the square) to start with ... you may find later that the OFF position is best, but setting it to this position at this stage will do no harm.

3) Follow the installation instructions attached to your printer interface closely.

The communications protocol used for the printer (just for reference) is RS232C, with DATA and CTS, 8-bit characters, 1 start bit and 1 stop bit, no parity bit. It runs at 1200 baud.

If you have any problems in connecting the Aquarius 4-color printer to your computer, contact your dealer.

NOTES

LIST OF CHARACTERS, AND COMMAND QUICK-REFERENCE

TEXT MODE

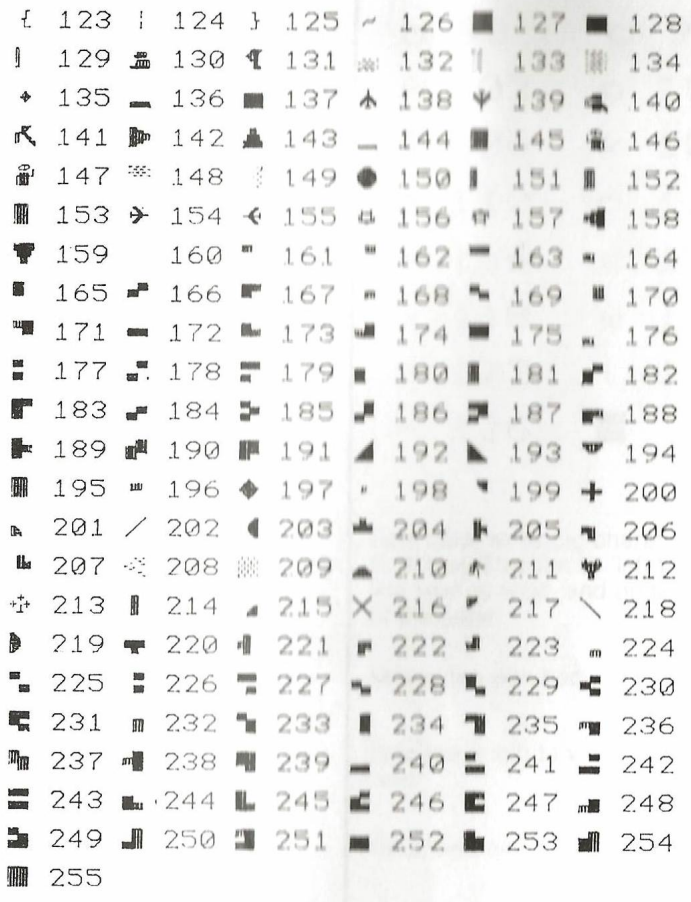
	32	!	33	"	34	#	35	$	36	%	37
&	38	'	39	(	40	)	41	*	42	+	43
,	44	-	45	.	46	/	47	0	48	1	49
2	50	3	51	4	52	5	53	6	54	7	55
8	56	9	57	:	58	;	59	<	60	=	61
>	62	?	63	@	64	A	65	B	66	C	67
D	68	E	69	F	70	G	71	H	72	I	73
J	74	K	75	L	76	M	77	N	78	O	79
P	80	Q	81	R	82	S	83	T	84	U	85
V	86	W	87	X	88	Y	89	Z	90	[	91
\	92	]	93	^	94	_	95	`	96	a	97
b	98	c	99	d	100	e	101	f	102	g	103
h	104	i	105	j	106	k	107	l	108	m	109
n	110	o	111	p	112	q	113	r	114	s	115
t	116	u	117	v	118	w	119	x	120	y	121
z	122	{	123	|	124	}	125	~	126	■	127

chr$(8)	backspace
chr$(9)	tab
chr$(10)	linefeed
chr$(11)	reverse linefeed
chr$(12)	form feed
chr$(13)	carriage return
chr$(29)	change color
chr$(18)	enter PLOTTER mode

MIXED MODE

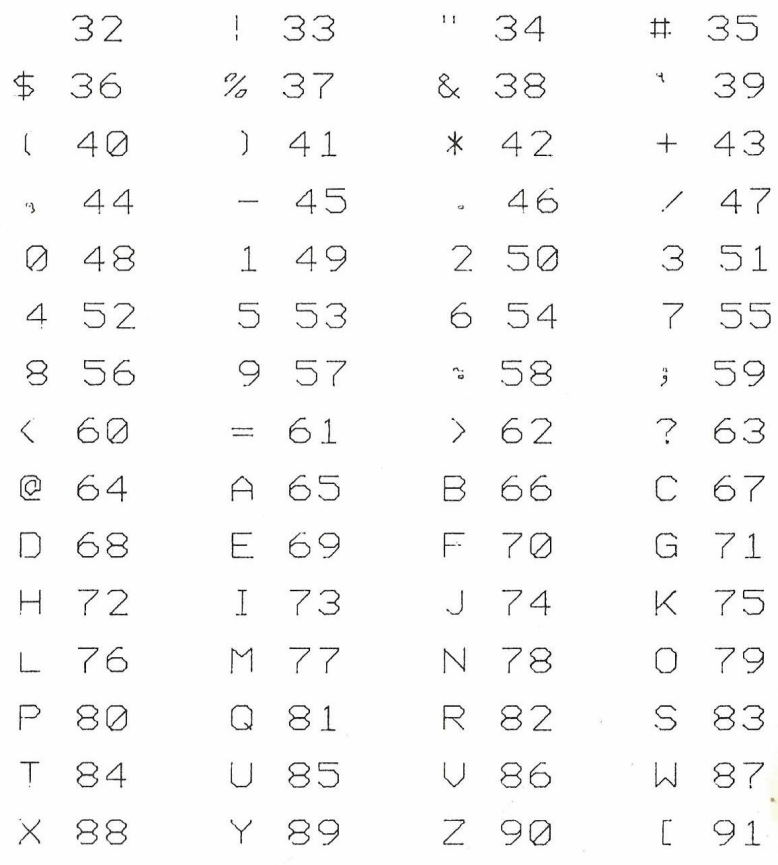
chr$(9) tab
chr$(10) linefeed
chr$(13) carriage return

£ 0	½ 1	¼ 2	¾ 3	÷ 4	© 5
→ 6	← 7	↑ 8	↙ 11	↘ 12	14
15	16	17	18	19	20
21	22	23	24	25	26
27	28	29	30	31	32
! 33	" 34	# 35	$ 36	% 37	& 38
' 39	(40	) 41	* 42	+ 43	, 44
- 45	. 46	/ 47	0 48	1 49	2 50
3 51	4 52	5 53	6 54	7 55	8 56
9 57	: 58	; 59	< 60	= 61	> 62
? 63	@ 64	A 65	B 66	C 67	D 68
E 69	F 70	G 71	H 72	I 73	J 74
K 75	L 76	M 77	N 78	O 79	P 80
Q 81	R 82	S 83	T 84	U 85	V 86
W 87	X 88	Y 89	Z 90	[91	\ 92
] 93	^ 94	_ 95	` 96	a 97	b 98
c 99	d 100	e 101	f 102	g 103	h 104
i 105	j 106	k 107	l 108	m 109	n 110
o 111	p 112	q 113	r 114	s 115	t 116
u 117	v 118	w 119	x 120	y 121	z 122


123 124 125 126 127 128
129 130 131 132 133 134
135 136 137 138 139 140
141 142 143 144 145 146
147 148 149 150 151 152
153 154 155 156 157 158
159 160 161 162 163 164
165 166 167 168 169 170
171 172 173 174 175 176
177 178 179 180 181 182
183 184 185 186 187 188
189 190 191 192 193 194
195 196 197 198 199 200
201 202 203 204 205 206
207 208 209 210 211 212
213 214 215 216 217 218
219 220 221 222 223 224
225 226 227 228 229 230
231 232 233 234 235 236
237 238 239 240 241 242
243 244 245 246 247 248
249 250 251 252 253 254
255

PLOTTER MODE

This diagram shows the character set for the 'P' command — see the list of commands later:



\ 92	] 93	^ 94	_ 95
` 96	a 97	b 98	c 99
d 100	e 101	f 102	g 103
h 104	i 105	j 106	k 107
l 108	m 109	n 110	o 111
p 112	q 113	r 114	s 115
t 116	u 117	v 118	w 119
x 120	y 121	z 122	{ 123
| 124	} 125	~ 126	■ 127

Iprint "A"
'A' "All normal"

Sets color to black, character size to 0, text direction to 'left to right', line type to solid, and origin to left of the paper

Iprint "H"
'H' 'Home'

Moves the pen back to the origin

Iprint "I"
'I' "Is the origin"

Sets the origin to where the pen is now

Iprint "C0"
'C' "Color"

Sets the color: 0 is black
1 is blue
2 is green
3 is red

	lprint "LØ" 'L' "Line type"	Sets the line type to anywhere from Ø (solid) to 253 (very long dashes)
	lprint "Phello" 'P' "Print text"	Prints whatever comes after as text
	lprint "S3" 'S' "Size"	Sets the size of the text from Ø (smallest) to 9 (largest)
	lprint "QØ" 'Q' "Direction"	Sets the direction of the text: Ø is normal 1 is bottom to top 2 is right to left 3 is top to bottom
	lprint "D100,100" 'D' "Draw to"	Draw a line to this point
	lprint "M100,100" 'M' "Move to"	Move the pen to this point without drawing
	lprint "J100,100" 'J' "Draw this much"	Draw a line like this
	lprint "R100,100" 'R' "Move this much"	Move the pen like this without drawing
	lprint "Z" 'Z' "Finished"	Go back into normal TEXT mode

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